APPENDIX B CALCULATIONS

BY: EKS	DATE: 11/17/2008 SUBJECT: SOUTHLAND WWTF JOB NO. 19996.17
CHKD. BY:	DATE: EXISTING TREATMENT CAPACITY
BOD Removal in Ponds	
DOD Kellioval III i olius	
Cn 1	
F	First order for <i>n</i> equally sized lagoons in series (ref. M&E p 843)
C _o 1+(k/nt) ⁿ	
C _o	
	First order for each lagoon with unique volume and/ or removal rate (ref. M&E p 843)
1+(kV/Q)	
Effluent BOD₅ Goal	
C =	80 mg/L* (conserv. assumption of 80% of eff. Limitation)
0 -	
Inffluent BOD ₅	
C _o =	360 mg/ L (Sept06 - Aug08 90th percentile BOD ₅)
Estimated Inf. BOD _u =	529.2 mg/ L (inf. BOD ₅ x 1.47)
	020.2
$k_{T} = k_{20}(1.036)^{T-20}$	
k ₂₀ =	0.276 d ⁻¹ (first-order rate constant at 20°C)
$T_L =$	49.4 °F (Approximate ground temp., Dec)
=	$9.7 ^{\circ}\text{C} = 282.8 ^{\circ}\text{K}$
– Т _н =	71.5 °F (Approximate ground temp., July)
=	$21.9 ^{\circ}\text{C} = 295.1 ^{\circ}\text{K}$
-	21.9 0 = 233.1 K
k _L =	0.19 d ⁻¹
k _H =	0.30 d ⁻¹
Flows (current 2008)	
Jan-08	0.638 mgd = Q_{H} (Conservative flow)
Mar-08	$0.57 \text{ mgd} = Q_L$
Permitted MMF	$0.900 \text{ mgd} = Q_{\text{MMF}}$
I ennined wiwi	
Volumes	
	Primary = 295,700 ft^3
'	= 2,211,984 gallons
	Fraction of Secondary Ponds for clarification: 0
S	Secondary = 417,300 ft ³ (total volume available for aeration)
	= 3,121,613 gallons

BY: EKS	DATE: 11/17/2008 S	UBJECT: SOUTHLAND WWTF JOB NO.	19996.17
CHKD. BY:	DATE:	EXISTING TREATMENT CAPACITY	
Aeration requirement (or	kygen demand)		
O_2 demand (lb/ day) = Co	x 1.5 x Q _{Ave} x 8.34e-6	Note: 1mg/L = 8.34e-6 lb/gal;	
Calculated oxygen deman	ds		
Cu =	540 mg/ L (1.5 x Co)	
Q, =	570,000 gpd		
Q _H =	638,000 gpd		
Q _{MMF} =	900,000 gpd		
Oxygen d	emand for low flow rate:	2,567.1 lb O₂/ day	
Oxygen de	mand for high flow rate:	2,873.3 lb O ₂ / day	
Oxygen demand f	or permit MMFflow rate:	4,053.2 lb O ₂ / day	

BY:	EKS	DATE: <u>11/17/2008</u> SUBJECT: <u>SOUTHLAND WWTF</u> JOB NO. <u>19996.17</u>
CHKD. BY:		DATE: EXISTING TREATMENT CAPACITY
Current Syste	em Aeration	n Capacity
		ansfer rate for low-speed surface aerators
		B C _W - C ₁
N =	N _o x -	x 1.024 ^{T-20} x a
		C _{S 20}
	N _o =	2.5 lb O_2 / HP.hr (O_2 transferred under std. cond. for low-speed surface)
	B =	1 (salinity-surface tension factor, typically 1)
	C _{WL} =	11.0 mg/ L (oxygen saturation concentration at temp 9.7C and 300 ft, M&E)
	C _{W H} =	8.5 mg/ L (oxygen saturation concentration at temp 21.9C and 300 ft, M&E)
	$C_1 =$	2.0 mg/ L (operating oxygen concentration)
	Cs 20 =	9.08 mg/ L (oxygen saturation concentration at temp 20C)
	$T_L =$	49.4 °F (Approximate ground temp., Dec)
	=	9.7 °C
	T _H =	71.5 °F (Approximate ground temp., July)
	=	21.9 °C
	a =	0.82 oxygen transfer correction factor for municipal wastewater
	N	
	N _L =	1.95 lb O_2 / HP.hr (low temp)
	N _H =	2.01 lb O ₂ / HP.hr (high temp)
Avail	able HP =	110 HP (for surface aerators)
, want		
	$AOTR_{L} =$	5140.8 lb O ₂ / day (low temp)
	AOTR _H =	5295.8 lb O ₂ / day (high temp)

ВΥ	: EKS		008 SUBJECT:	SOUTHLAND WWTF	JOB NO.	19996.17
CHKD. BY		DATE:		EXISTING TREATMEN		10000.11
onne. Bi						
Four Pon	ds in Series -	Winter Season (Lov	v temp & low flow	v condition)		
Pond #1		2,211,984 gallons				
	Q =	570,000 gpd				
	$k_L =$	0.19 d ⁻¹				
	t =	3.88 days				
	C _o =	360 mg/L				
	C ₁ =	206.5 mg/ L				
Pond #2	V ₂ =	2,211,984 gallons				
	Q =	570,000 gpd				
	$k_L =$	0.19 d⁻¹				
	t =	3.88 days				
	C ₁ =	206.5 mg/ L				
	C ₂ =	118.5 mg/ L				
Pond #3	V ₃ =	3,121,613 gallons				
	Q =	570,000 gpd				
	$k_L =$	0.19 d ⁻¹				
	t =	5.48 days				
	C ₂ =	118.5 mg/ L				
	C ₃ =	57.8 mg/ L				
Pond #4	V ₄ =	3,121,613 gallons				
	Q =	570,000 gpd				
	k _L =	0.19 d ⁻¹				
	t =	5.48 days				
	C ₃ =	57.8 mg/ L				
	C ₄ =	28.2 mg/ L		total retention time =	= 18.71	
	% reduction =	92%				
l						

BY:	EKS			SOUTHLAND WWTF	JOB NO. 19996.1
CHKD. BY:	LIND	DATE: 11/1//20		EXISTING TREATMENT	
		DATE		EXISTING TREATMENT	CAPACITY
Four Ponds	s in Series -	Summer Season (Hig	gh temp & hig	h flow condition)	
Pond #1	V ₁ =	2,211,984 gallons			
	Q =	638,000 gpd			
	k _H =	0.30 d ⁻¹			
	t =	3.47 days			
	C _o =	360 mg/L			
	C ₁ =	177.8 mg/ L			
Pond #2	V. –	2,211,984 gallons			
	v ₂ = Q =	638,000 gpd			
		0.30 d ⁻¹			
	к _н =				
	t =	3.47 days			
	C ₁ =	177.8 mg/ L			
	C ₂ =	87.8 mg/ L			
Pond #3	V ₃ =	3,121,613 gallons			
	Q =	638,000 gpd			
	k _H =	0.30 d ⁻¹			
	t =	4.89 days			
	C ₂ =	87.8 mg/ L			
	C ₃ =	35.9 mg/ L			
Pond #4	V4 =	3,121,613 gallons			
	Q =	638,000 gpd			
	е – к _н =	0.30 d ⁻¹			
	t =	4.89 days			
	C ₃ =	35.9 mg/ L			
	$C_{3} = C_{4} =$	14.7 mg/ L		total rotantian time	46 70
	04 =	14.7 mg/ L		total retention time =	16.72
%	reduction =	96%			
1					
1					

BY:	EKS			SOUTHLAND WWTF	JOB NO.	19996.17
CHKD. BY:	LING	DATE: 11/1//20		EXISTING TREATMEN	-	19990.17
		DATE				
Four Ponds i	in Series -	MMF Summer Seaso	on (High temp	& MMF flow condition)		
Pond #1	V ₁ =	2,211,984 gallons				
	Q =	900,000 gpd				
	k _H =	0.30 d-1				
	t =	2.46 days				
	C _o =	360 mg/L				
	C ₁ =	208.5 mg/ L				
Pond #2	V ₂ =	2,211,984 gallons				
	Q =	900,000 gpd				
	k _H =	0.30 d ⁻¹				
	t =	2.46 days				
	C ₁ =	208.5 mg/ L				
	C ₂ =	120.8 mg/ L				
Pond #3	V ₃ =	3,121,613 gallons				
	Q =	900,000 gpd				
	k _H =	0.30 d ⁻¹				
	t =	3.47 days				
	C ₂ =	120.8 mg/ L				
	C ₃ =	59.6 mg/ L				
Pond #4		3,121,613 gallons				
	Q =	900,000 gpd				
	k _H =	0.30 d ⁻¹				
	t =	3.47 days				
	C ₃ =	59.6 mg/ L				
	C ₄ =	29.4 mg/ L		total retention time =	11.85	
% re	eduction =	92%				

BY	EKS				SOUTHLAND			19996.17
CHKD. BY		DATE:	1/1//2000		EXISTING TRE			13330.17
CIIND. DI	-	DATE.		-				
Two Pond	s in Series, T	wo parallel fl	ow trains ·	Winter Sea	ason (Low temp	& low flo	ow condition	
Pond #1		2,211,984 g						
	Q =	285,000 g						
	$k_L =$	0.19 d	-1					
	t =	7.76 d	ays					
	C _o =	360 m	ng/L					
	C ₁ =	144.8 m	ng/ L					
Pond #4	V ₃ =	3,121,613 g	allons					
	Q =	285,000 g						
	k _L =	0.19 d						
	t =	10.95 d						
	C ₁ =	144.8 m						
	C ₃ =	46.7 m	-					
	03 -	40.7 11	ig/ L					
Pond #2	$V_2 =$	2,211,984 g	allons					
	Q =	285,000 g						
	$k_L =$	0.19 d						
	t =	7.76 d						
	C _o =	360 m						
		144.8 m						
	02-	14.011	ig/ L					
Pond #3	$V_4 =$	3,121,613 g	allons					
	Q =	285,000 g						
	$k_L =$	0.19 d						
	t =	10.95 d	ays					
	C ₂ =	144.8 m						
	C ₄ =	46.7 m	-		total retenti	on time =	18.71	
9	% reduction =	87%						

	A EVO		,		KS, PLANNER			40000 47
	Y: EKS		11/1//2008	SUBJECT	SOUTHLAND		-	19996.17
CHKD. B	Y:	DATE:		_	EXISTING TRE	ATMEN	F CAPACITY	
Two Pon	de in Series T	wo narallal	flow trains	- Summor S	eason (High ter	nn & hia	h flow condit	ion)
1001011	us in Genes, i		now trains	- Summer C	eason (mgn ten	np a mg		
Pond #1	V ₁ =	2,211,984	gallons					
	Q =	319,000						
	k _H =	0.30						
	t =	6.93						
	C _o =	360						
	C ₁ =	118.0						
	01	110.0	iiig/ E					
Pond #4	V ₂ =	3,121,613	gallons					
	Q =	319,000	-					
	k _H =	0.30						
	t =	9.79						
	$C_1 =$	118.0						
	$C_{1} = C_{3} =$	30.3						
	U ₃ –	30.3	mg/ ∟					
Pond #2	V. –	2,211,984	gallone					
	$v_2 = Q =$	319,000						
	Q = k _H =	0.30	gpa d ⁻¹					
	t =	6.93						
	C _o =	360						
	C ₂ =	118.0	mg/ L					
	V -	0 404 640	aollono					
Pond #3		3,121,613	-					
	Q =	319,000 0.30						
	k _H =							
	t =	9.79						
	C ₂ =	118.0						
	C ₄ =	30.3	mg/ L		total retention	on time =	16.72	
	% reduction	0.28/						
	% reduction =	92%						

DV.	EKS				RS, PLANN			10006 17
BY:	EV2		11/1//2000	SUBJECT:			-	19996.17
CHKD. BY:		DATE:		_	EXISTING	IREAIMEN	IT CAPACITY	
Two Ponds	in Series. T	wo parallel	flow trains	- MMF Sumi	mer Season	(High temp	& MMF flow	cond.)
ine i ende		no paranoi				(ingli tomp		oonaly
Pond #1	V ₁ =	2,211,984	gallons					
	-	450,000	-					
	k _H =	0.30						
	t =	4.92						
	$C_o =$	360						
	$C_0 = C_1 =$	146.7	-					
	01 -	140.7	mg/ ∟					
Pond #4	V. –	3,121,613	gallone					
		450,000						
	Q = k _н =	430,000						
	t =	6.94						
	C ₁ =	146.7	-					
	C ₃ =	48.1	mg/ L					
Pond #2	V. =	2,211,984	aallons					
	Q =	450,000						
	с = k _H =	0.30						
	t =	4.92						
	C _o =	360	-					
	C ₂ =	146.7	mg/ L					
Pond #3	$V_4 =$	3,121,613	aallons					
	Q =	450,000	-					
	k _H =	0.30						
	t =	6.94						
	$C_2 =$	146.7						
	$C_2 = C_4 =$	48.1	-		total rat	ontion time	14 05	
	C ₄ =	46.1	mg/ L		lotarrei	ention time =	= 11.85	
%	reduction =	87%						
*M&E Refere	ence: Waster	water Engin	eering Treat	ment and Re	use, 4th Edit	tion		
IVIAE RETERE	ence: waste	water Engin	eening rreat	nent and Re	use, 4th Edi	lion		

BY:	EKS		1//2008	8 SUBJECT: SOUTHLAND WWTF JOB NO. 19996.1
CHKD. BY:		DATE:		TREATMENT CAPACITY FOR FUTURE FLOWS
BOD Remova	I in Ponds			
Cn	1			
=		First order for n	equally s	sized lagoons in series (ref. M&E p 843)
C _o	1+(k/nt) ⁿ			
	Co			
C =	 1+(kV/Q)	First order for ea	ch lagoo	oon with unique volume and/ or removal rate (ref. M&E p 843)
	11(((()/(d))			
Effluent BOD ₅	Goal			
	C =	80 mg/	L* (conse	serv. assumption of 80% of eff. Limitation)
Inffluent BOD ₅				
	, C _o =	360 mg/	L (Dec 0	05 - Aug 06 90th percentile BOD ₅)
Estimated	Inf. BOD _u =	529.2 mg/	L (inf. BC	BOD ₅ x 1.47)
$k_{\rm T} = k_{20}(1.036)$) ^{T-20}			
. 20(k ₂₀ =			der rate constant at 20°C)
	$T_L =$			mate ground temp., Dec)
	=	9.7 °C		= 282.8 °K
	Τ _H = =	71.5 F (/ 21.9 °C		mate ground temp., July) = 295.1 °K
			-	
	k _L =	0.19 d ⁻¹ 0.30 d ⁻¹		
	k _H =	0.30 u		
Flows (project				
	PDF	3.34 mgc		= Q _H
	AAF MMF	1.67 mgc 2.24 mgc		= Q _L = Q _{MMF}
	IVIIVII	2.24 mgc		
Volumes		D.'		005 700 (13
	I	Primary	=	295,700 ft ³ 2,211,984 gallons
				-
	:	Secondary	=	417,300 ft ³ (total volume available for aeration) 3,121,613 gallons
				-, , .
Aeration requ	uirement (ox	(ygen demand)		
O ₂ demand (Ib	o/ day) = Co	x 1.5 x Q _{Ave} x 8.3	34e-6	Note: 1mg/L = 8.34e-6 lb/gal;
2				
Calculated oxy	ygen deman	ds		
	Cu =		L (1.5 x (x Co)
	Q _L =	1,670,000 gpd		
		3,340,000 gpd		
	Q _{MMF} =	2,237,800 gpd		
	Oxygen o	demand for low f	low rate:	e: 7,521.0 lb O ₂ / day
	-			
∩vv#		emand for high f for permit MMFf		-

BY:	EKS	DATE: 11/17/2008 S	UBJECT: SOUTHLAND	WWTF JOB NO. 19996.17
CHKD. BY:		DATE:	TREATMENT	CAPACITY FOR FUTURE FLOWS
Current System	Aeration C	apacity		
Calculate actual	oxygen tran	sfer rate for low-speed su	irface aerators	
		3 C _W - C _I		
N =	N _o x	x 1.024 ^{T-20} x a		
		C _{S 20}		
	N _o =	2.5 lb O ₂ / HP.hr (O	2 transferred under std. c	ond. for low-speed surface)
	B =		e tension factor, typically	
	C _{WL} =			at temp 9.7C and 300 ft, M&E)
	C _{W H} =			at temp 21.9C and 300 ft, M&E)
	C ₁ = Cs 20 =		ng oxygen concentration) saturation concentration	at temp 20C)
	$T_L =$		e ground temp., Dec)	at tonip 200)
	=	9.7 °C		
	T _H =	71.5 °F (Approximat	e ground temp., July)	
	=	21.9 °C		
	a =	0.82 oxygen transfe	r correction factor for mur	nicipal wastewater
	$N_L =$	1.95 lb O ₂ / HP.hr (le	ow temp)	
	N _H =	2.01 lb O ₂ / HP.hr (h	igh temp)	
Availa	ble HP =	110 HP		
	AOTR _L =	5140.8 lb O ₂ / day (low	v temp)	
	AOTR _H =	5295.8 lb O₂/ day (hig	ıh temp)	
Calculate amour	nt of horsepo	ower required to satisfy ox	kygen demand	
	Oxvaen de	mand for low flow rate:	7,521.0 lb O₂/ day	
		nand for high flow rate:	15,042.0 lb O ₂ / day	
Oxyge		or max month flow rate:	10,078.2 lb O ₂ / day	
	N			
	N _L = N _H =	1.95 lb O ₂ / HP.hr (lo 2.01 lb O ₂ / HP.hr (hi		
	IN _H =	2.01 ID O ₂ / 11 ² .111 (11	gir temp)	
or high flow rat	-	_	For max mont	
Total HP =	315.0 HF		Total HP =	210.0 HP
AOTR _L =	14721.3 lb	O ₂ / day (low temp)	AOTR _L =	9814.2 lb O₂/ day (low temp)
			-	

BY:	EKS	DATE:	11/17/2008	SUBJECT:	SOUTHLAND WWT		10.	19996.17
CHKD. BY:		DATE:		_	TREATMENT CAPA	CITY FOR	FUTURE FL	OWS
Ponds in Serie Current System				ow flow cond	lition)			
Pond #1		2,211,984						
FUIU #1		1,670,000	•					
		0.19						
	t =	1.32						
	$C_0 =$	360						
	-	287.2	0					
	U ₁ =	201.2	mg/ ∟					
Pond #2	V ₂ =	2,211,984	gallons					
	Q =	1,670,000	gpd					
	k _L =	0.19	d ¹					
	t =	1.32	days					
	C ₁ =	287.2	mg/ L					
	C ₂ =	229.1	mg/ L					
Pond #3	V ₃ =	3,121,613	gallons					
	Q =	1,670,000	gpd					
	k, =	0.19						
	t =	1.87	days					
	C ₂ =	229.1	mg/ L					
	C ₃ =	168.7	mg/ L					
Pond #4	V4 =	3,121,613	gallons					
	Q =	1,670,000	gpd					
	k _L =	0.19						
	t =	1.87	days					
	C ₃ =							
	C ₄ =	124.2	mg/ L					
current % r	eduction =	65%			total retention tin	ne =	6.39 days	

BY:	EKS	DATE:	11/17/2008 SUBJECT:	SOUTHLAND WWTF	JOB NO	. 19996.1
CHKD. BY:		DATE:		TREATMENT CAPAC		
Ponds in Serie	s - Winter	Season (Lo	ow temp & low flow cond	lition)		
Add two ponds,						
Pond #1	V -	2,211,984	collons			
		1,670,000	-			
	& = k _L =					
	κ_ =	1.32				
	$C_{o} =$	360				
	C ₀ =	287.2	-			
			0			
Pond #2	V ₂ =	2,211,984	gallons			
		1,670,000				
	k _L =					
	t =	1.32	•			
	C ₁ =	287.2	-			
	C ₂ =	229.1	mg/ L			
Pond #3	V3 =	3,121,613	gallons			
		1,670,000	-			
	k _L =	0.19				
	t =	1.87	days			
	C ₂ =	229.1	mg/ L			
	C ₃ =	168.7	mg/ L			
Pond #4	V -	3,121,613	collons			
0110 #4		1,670,000	-			
	k, =					
	t =	1.87				
	C ₃ =	168.7	•			
	C ₄ =	124.2	-			
		0 404 040				
New Pond 5	-	3,121,613	•			
		1,670,000 0.19				
	k =					
	t =	1.87 124.2				
	C ₄ =					
	C ₅ =	91.5	mg/ L			
New Pond 6		3,121,613				
		1,670,000				
	$k_{L} =$	0.19				
	t =	1.87	•			
	C ₅ =	91.5	mg/ L			
	C ₆ =	67.4	mg/ L			
	reduction	81%		total retention time	= 10	.13 days

В	Y: EKS	DATE:	11/17/2008	SUBJECT:	SOUTHLAND	D WWTF	JOB NO.	19996.17
CHKD. B	Y:	DATE:			TREATMEN	T CAPACI	TY FOR FU	TURE FLOWS
	Series - Summe	•		high flow c	ondition)			
	stem Under 203							
Pond #1		2,211,984 g						
		3,340,000 g						
	k _H =	0.30 0						
	t =	0.66 c						
	C _o =	360 r	ng/L					
	C ₁ =	301.1 r	ng/ L					
Pond #2	V ₂ =	2,211,984 g	gallons					
	Q =	3,340,000 g	gpd					
	k _H =	0.30	d ⁻¹					
	t =	0.66 c	lays					
	C ₁ =	301.1 r	ng/ L					
	C ₂ =	251.8 r	ng/ L					
Pond #3	V ₃ =	3,121,613 g	gallons					
	Q =	3,340,000 g	gpd					
	k _H =	0.30	J ⁻¹					
	t =	0.93 c	lays					
	C ₂ =	251.8 r	ng/ L					
	C ₃ =	197.3 r	ng/ L					
Pond #4	V ₄ =	3,121,613 g	gallons					
	Q =	3,340,000 g	jpd					
	k _H =	0.30	J ⁻¹					
	t =	0.93 c	lays					
	C ₃ =	197.3 r						
	C ₄ =	154.5 r	ng/ L		total reter	ntion time =	= 3.1	9 days
	% reduction =	57%						

CHKD. BY:		DATE:		TRE	ATMENT	CAPACITY F	OR FUTURE FLOWS
Ponds in Serie	s - Summe	er Season (High temp & hi	gh flow condit	tion)		
Add two ponds,							
Pond #1		2,211,984					
		3,340,000 0.30					
	k _H =						
	t =	0.66	-				
	C _o =	360	-				
	C ₁ =	301.1	mg/ L				
Pond #2	V ₂ =	2,211,984	gallons				
	Q =	3,340,000					
	k _H =	0.30	d ⁻¹				
	t =	0.66	days				
	C ₁ =	301.1	mg/ L				
	C ₂ =	251.8	mg/ L				
Pond #3	V -	3,121,613	gollong				
	-	3,340,000	•				
	са = k _H =	0.30					
	t =	0.93					
	$C_2 =$	251.8	-				
	-	197.3					
	C ₃ =	197.3	mg/∟				
Pond #4	V ₄ =	3,121,613	gallons				
	Q =	3,340,000					
	k _H =	0.30	d ⁻¹				
	t =	0.93	days				
	C ₃ =	197.3	mg/ L				
	C ₄ =	154.5	mg/ L				
New Pond 5	V _e =	3,121,613	dallons				
		3,340,000	-				
	к _н =	0.30					
	t =	0.93	davs				
	C ₄ =	154.5	-				
	C ₅ =		mg/ L				
New Pond 6		3,121,613					
		3,340,000	gpd d ⁻¹				
	k _H =	0.30					
	t =	0.93					
	C ₅ =	121.1	-				
	C ₆ =	94.9	mg/ L				5.00
Two ponds don'	t reach eff	uent goal, tr	y additional pon		otal retenti	ion time =	5.06 days
New Pond 7		3,121,613	•				
		3,340,000 0.30					
	k _H =						
	t =		days				
	C ₆ = C ₇ =		mg/ L mg/ L				
			····g· =				
% re	duction =	79%		t	otal retenti	ion time =	6.00 days

B	BY: EKS	DATE:	11/17/2008	SUBJECT:	SOUTHLAN	D WWTF	JOB NO).	19996.17
CHKD. B	BY:	DATE:			TREATMEN	T CAPACI	TY FOR F		OWS
	Series - MMF S			np & MMF i	low conditio	n)			
-	stem Under 203								
Pond #1		2,211,984	•						
		2,237,800							
	k _H =	0.30							
	t =	0.99							
	C _o =	360	mg/L						
	C ₁ =	278.6	mg/ L						
Pond #2	V ₂ =	2,211,984	gallons						
	Q =	2,237,800	gpd						
	k _H =	0.30	d ⁻¹						
	t =	0.99	days						
	C ₁ =	278.6	mg/ L						
	C ₂ =	215.6	mg/ L						
Pond #3	V ₃ =	3,121,613	gallons						
	Q =	2,237,800	gpd						
	k _H =	0.30	d ⁻¹						
	t =	1.39	days						
	C ₂ =	215.6	mg/ L						
	C ₃ =	152.6	mg/ L						
Pond #4	V ₄ =	3,121,613	gallons						
	Q =	2,237,800							
	k _H =	0.30	d⁻¹						
	t =	1.39	days						
	C ₃ =	152.6	mg/ L						
	C ₄ =	108.1	mg/ L		total reter	ntion time =	= 4	l.77 days	
	% reduction =	70%							

	EKS		11/1//20	08 SUBJEC	T: SOUTHLAI				96.1
CHKD. BY:		DATE:			TREATME	NT CAPAC	ITY FOR FL	JTURE FLOW	S
Ponds in Series	MMES	ummor Soo	oon (Lligh	tomp 9 MM	E flow conditi	ion)			
Add ponds V = 3			Son (righ			ionj			
	1.2.10.0	ganorio							
Pond #1	V ₁ =	2,211,984	gallons						
	Q =	2,237,800	gpd						
	k _H =	0.30	d ⁻¹						
	t =	0.99	days						
	C _o =	360	mg/L						
	C ₁ =	278.6							
Pond #2	V2 =	2,211,984	gallons						
	-	2,237,800	•						
	к _н =	0.30							
	t =	0.99							
		278.6							
	C ₂ =	215.6	-						
Pond #3	V _a =	3,121,613	nallons						
		2,237,800							
	са – k _н =	0.30	d ⁻¹						
	t =	1.39							
		215.6							
		152.6							
	U ₃ =	152.0	ing/ L						
Pond #4	V4 =	3,121,613	gallons						
	Q =	2,237,800	gpd						
	k _H =	0.30							
	t =	1.39	days						
	C ₃ =	152.6							
	C ₄ =	108.1							
New Pond 5	V ₅ =	3,121,613	gallons						
	-	2,237,800	•						
	k _н =	0.30							
	t =	1.39	days						
	C4 =	108.1							
	C ₅ =	76.5							
% rec	duction =	79%			total ret	ention time	= 6	16 days	
For ponds in seri		1070			.0101701		0.		
One additional p		I treat the wa	stewater	to acceptable	levels during	high temp	max month	flow conditions	s

E	BY: EKS	DATE:	11/17/2008 SUBJECT	SOUTHLAND WWT	F JOBN	NO. 19996.17
CHKD. E	SY:	DATE:		TREATMENT CAPA	CITY FOR	R FUTURE FLOWS
_						
-			son (Low temp & low fl	ow condition)		
	/stem Under 203					
Pond #1		2,211,984				
	Q =	835,000				
	k _L =	0.19				
	t =	2.65	•			
	C _o =	360	mg/L			
	C ₁ =	238.8	mg/ L			
Pond #4	$V_4 =$	3,121,613	gallons			
	Q =	835,000	gpd			
	k _L =	0.19	d ⁻¹			
	t =	3.74	days			
	C ₁ =	238.8	mg/ L			
	C ₄ =	139.2	mg/ L			
Pond #2	V ₂ =	2,211,984	gallons			
	Q =	835,000	gpd			
	k _L =	0.19	d ⁻¹			
	t =	2.65	days			
	C _o =	360	mg/L			
	C ₂ =	238.8	mg/ L			
Pond #3	V ₃ =	3,121,613	gallons			
	Q =	835,000	gpd			
	$k_{L} =$	0.19				
	t =	3.74	days			
	C ₂ =	238.8	mg/ L			
	C ₃ =	139.2	mg/ L	total retention tim	ne =	6.39 days
	% reduction =	61%				

CHKD. BY:		DATE: DATE:		1	REATMENT CA	APACITY F	OR FUTURE FLOW
				-			
Two parallel flov Add two ponds, V				& low flov	v condition)		
Add two polids,	7 - 0,121,	oro galiona	each				
Pond #1	V ₁ =	2,211,984	gallons				
	Q =	835,000	gpd				
	k _L =	0.19	d ⁻¹				
	t =	2.65	days				
	C _o =	360	mg/L				
	C ₁ =	238.8	mg/ L				
Pond #4	V ₄ =	3,121,613	gallons				
	Q =	835,000	gpd				
	$k_L =$	0.19	d ⁻¹				
	t =	3.74	days				
	C ₁ =	238.8	mg/ L				
	C ₄ =	139.2					
New Pond 5	V ₅ =	3,121,613	gallons				
	Q =	835.000	apd				
	k _L =		d ⁻¹				
	t =	3.74	days				
	C ₄ =	139.2	mg/ L				
	C ₅ =	81.1					
Pond #2	V ₂ =	2,211,984	gallons				
	Q =	835.000	apd				
	k _L =	0.19	d ⁻¹				
	t =						
	C _o =	360	mg/L				
	C ₂ =	238.8	mg/ L				
Pond #3	V ₃ =	3,121,613	gallons				
	Q =	835.000	apd				
	k _L =		d ⁻¹				
	t =	3.74	days				
	C ₂ =	238.8	mg/ L				
	C ₃ =	139.2					
New Pond 6	V ₆ =	3,121,613	gallons				
	Q =	835,000	gpd				
	k _L =	0.19	d ⁻¹				
	t =		days				
	C ₃ =	139.2	mg/ L				
	C ₆ =	81.1			total retention	time =	10.13 days
0/ ===	luction =	77%					

B	BY: EKS	DATE: 11/	17/2008 SUBJE	CT: SOUTHLAND) WWTF	JOB NO.	19996.17
CHKD. B	BY:	DATE:		TREATMENT	CAPACI	TY FOR FUT	URE FLOWS
			on (High temp &	high flow conditi	on)		
	/stem Under 203						
Pond #1		2,211,984 gall					
		1,670,000 gpc	1				
	k _H =	0.30 d ⁻¹					
	t =	1.32 day					
	C _o =	360 mg	/L				
	C ₁ =	258.7 mg	/ L				
Pond #4	V ₃ =	3,121,613 gal	ons				
	Q =	1,670,000 gpc	1				
	k _H =	0.30 d ⁻¹					
	t =	1.87 day	'S				
	C ₁ =	258.7 mg					
	C ₃ =	166.6 mg	/ L				
Pond #2	V ₂ =	2,211,984 gall	ons				
	Q =	1,670,000 gpc	1				
	k _H =	0.30 d ⁻¹					
	t =	1.32 day	'S				
	$C_0 =$	360 mg					
	C ₂ =	258.7 mg					
Pond #3	V ₄ =	3,121,613 gall	ons				
	Q =	1,670,000 gpc	ł				
	k _H =	0.30 d ⁻¹					
	t =	1.87 day	'S				
	C ₂ =	258.7 mg					
	C ₄ =	166.6 mg		total reten	tion time =	= 3.19	days
	% reduction =	54%					

BY:	EKS	DATE: 11/17/2008	SUBJECT: SOUTHLAND WWTF JOB NO. 19996.17
CHKD. BY:		DATE:	TREATMENT CAPACITY FOR FUTURE FLOWS
Two narallel f	ow trains	Summer Season (High	emp & high flow condition)
		,613 gallons each	emp a migh now condition,
Pond #1		2,211,984 gallons	
		1,670,000 gpd	
	k _H =	0.30 d ⁻¹	
	t =	1.32 days	
	C _o =	360 mg/L	
	C ₁ =	258.7 mg/ L	
Pond #4	V ₃ =	3,121,613 gallons	
		1,670,000 gpd	
	k _H =	0.30 d ⁻¹	
	t =	1.87 days	
	C ₁ =	258.7 mg/ L	
	C ₃ =	166.6 mg/ L	
New Pond 1	V _e =	3,121,613 gallons	
New Fond F		1,670,000 gpd	
	са = k _H =	0.30 d ⁻¹	
	t =	1.87 days	
	C ₃ =	166.6 mg/ L	
	C ₅ =	107.3 mg/ L	
New Pond 2		3,121,613 gallons	
	Q = k _H =	1,670,000 gpd 0.30 d⁻¹	
	κ _H = t =	1.87 days	
	$C_5 =$	107.3 mg/ L	
	C ₇ =	69.1 mg/ L	
Pond #2		2,211,984 gallons	
		1,670,000 gpd	
	к _н =	0.30 d ⁻¹	
	t =	1.32 days	
	$C_0 = C_2 =$	360 mg/L 258.7 mg/ L	
	02 =	230.7 mg/ L	
Pond #3	$V_4 =$	3,121,613 gallons	
	Q =	1,670,000 gpd	
	k _H =	0.30 d⁻¹	
	t =	1.87 days	
	C ₂ =	258.7 mg/ L	
	C ₄ =	166.6 mg/ L	
New Pond 3	V2 =	3,121,613 gallons	
		1,670,000 gpd	
	k _H =	0.30 d ⁻¹	
	t =	1.87 days	
	C ₄ =	166.6 mg/ L	
	C ₆ =	107.3 mg/ L	
New Pond 4	V -	3,121,613 gallons	
		1,670,000 gpd	
	са = k _н =	0.30 d ⁻¹	
	t =	1.87 days	
	C ₆ =	107.3 mg/ L	
	C ₈ =	69.1 mg/ L	
	-0	·····	total retention time = 6.93 days
% r	eduction =	81%	-
For two paralle	I flow trains		
			ter to acceptable levels during high temp, high flow conditions

			BOYLE	EENGIN	IEER	ING				
		Ε	NGINEERS,	SURVEYO	ORS, PL	ANNERS	5			
E	BY: EKS	DATE:	11/17/2008	SUBJECT:	SOUTH	LAND WV	VTF	JOB NO.	19	9996.17
CHKD. E	BY:	DATE:			TREAT	MENT CA	PACIT	Y FOR FU	TURE FLO	NS
T		MME Com		Illark town	0 BABAT 4		,			
	Ilel flow trains - stem Under 203			High temp	& IVIIVIF TI	low cond	•)			
Pond #1		2,211,984								
		1,118,900	•							
	k _H =	0.30								
	t =	1.98	days							
	C _o =	360								
	C ₁ =	227.2	mg/ L							
Pond #4	V ₃ =	3,121,613	gallons							
		1,118,900	-							
	k _H =	0.30	d ⁻¹							
	t =	2.79	days							
	C ₁ =	227.2	mg/ L							
	C ₃ =	124.5	mg/ L							
Pond #2	V ₂ =	2,211,984	gallons							
	Q =	1,118,900	gpd							
	k _H =	0.30	d ⁻¹							
	t =	1.98	days							
	C _o =	360	mg/L							
	C ₂ =	227.2	mg/ L							
Pond #3	V ₄ =	3,121,613	gallons							
	Q =	1,118,900	gpd							
	k _H =	0.30	d ⁻¹							
	t =	2.79	days							
	C ₂ =	227.2	mg/ L							
	C ₄ =	124.5			total	retention	time =	4.7	7 days	
	% reduction =	65%								

EKS		<u>11/17/2008</u> SU	BJECI:			_	-	19996.1
	DATE:			TREATME	NT CAPACI	TY FOR	FUTURE F	LOWS
n Series, T	wo parallel	flow trains - MM	/IF Sumn	ner Season	(High temp	& MMF	flow cond	-)
		•						
		-						
-	360	mg/L						
C ₁ =	227.2	mg/ L						
V ₃ =	3,121,613	gallons						
		-						
k _H =								
t =	2.79	days						
C ₁ =	227.2	mg/ L						
C ₃ =								
	0 404 040							
-								
C ₅ =	68.2	mg/ L						
V ₂ =	2,211,984	gallons						
Q =								
k _H =	0.30	d ⁻¹						
t =	1.98	days						
C _o =	360	mg/L						
C ₂ =	227.2	mg/ L						
V. –	3 121 613	aallons						
		-						
	0.30	d ⁻¹						
	2.13	ma/l						
_	124.5	mg/ L						
04	.2.10							
Q =								
k _H =	0.30	d ⁻¹						
t =	2.79	days						
C ₄ =	124.5	mg/ L						
C ₆ =	68.2	mg/ L						
				total ret	ention time :	=	7.56 days	
	$\begin{array}{c} V=3,121\\ V_1=\\ Q=\\ k_{H}=\\ t=\\ C_{0}=\\ C_{1}=\\ V_{3}=\\ Q=\\ k_{H}=\\ t=\\ C_{3}=\\ V_{3}=\\ Q=\\ k_{H}=\\ t=\\ C_{3}=\\ V_{2}=\\ Q=\\ k_{H}=\\ t=\\ C_{2}=\\ V_{4}=\\ Q=\\ k_{H}=\\ t=\\ C_{2}=\\ C_{4}=\\ V_{3}=\\ Q=\\ k_{H}=\\ t=\\ C_{2}=\\ C_{4}=\\ V_{3}=\\ Q=\\ k_{H}=\\ t=\\ C_{2}=\\ C_{4}=\\ C_{4}=\\ C_{4}=\\ C_{5}=\\ $	$\begin{array}{c} \textbf{n Series, Two parallel}\\ \underline{V = 3,121,613 \ qallons}\\ V_1 = 2,211,984\\ Q = 1,118,900\\ k_H = 0.30\\ t = 1.98\\ C_0 = 3600\\ C_1 = 227.2\\ V_3 = 3,121,613\\ Q = 1,118,900\\ k_H = 0.30\\ t = 2.79\\ C_1 = 227.2\\ C_3 = 124.5\\ V_3 = 3,121,613\\ Q = 1,118,900\\ k_H = 0.30\\ t = 2.79\\ C_3 = 124.5\\ C_5 = 68.2\\ V_2 = 2,211,984\\ Q = 1,118,900\\ k_H = 0.30\\ t = 1.98\\ C_0 = 3600\\ C_2 = 227.2\\ V_4 = 3,121,613\\ Q = 1,118,900\\ k_H = 0.30\\ t = 1.98\\ C_0 = 3600\\ C_2 = 227.2\\ V_4 = 3,121,613\\ Q = 1,118,900\\ k_H = 0.30\\ t = 2.79\\ C_2 = 227.2\\ C_4 = 124.5\\ V_3 = 3,121,613\\ Q = 1,118,900\\ k_H = 0.30\\ t = 2.79\\ C_2 = 227.2\\ C_4 = 124.5\\ V_3 = 3,121,613\\ Q = 1,118,900\\ k_H = 0.30\\ t = 2.79\\ C_2 = 227.2\\ C_4 = 124.5\\ V_3 = 3,121,613\\ Q = 1,118,900\\ k_H = 0.30\\ t = 2.79\\ \end{array}$	n Series, Two parallel flow trains - MN , $V = 3,121,613$ gallons each $V_1 = 2,211,984$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 1.98 days $C_0 = 360$ mg/L $C_1 = 227.2$ mg/L $V_3 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_1 = 227.2$ mg/L $C_3 = 124.5$ mg/L $V_3 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_3 = 124.5$ mg/L $V_2 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_3 = 124.5$ mg/L $V_2 = 2,211,984$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 1.98 days $C_0 = 360$ mg/L $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $V_3 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $C_4 = 124.5$ mg/L	N Series, Two parallel flow trains - MMF Summ $V = 3.121.613$ gallons each $V_1 = 2.211.984$ gallons $Q = 1,118,900$ gpd $k_H = 0.30$ d ⁻¹ $t = 1.98$ days $C_0 = 360$ mg/L $C_1 = 227.2$ mg/L $V_3 = 3,121,613$ gallons $Q = 1,118,900$ gpd $k_H = 0.30$ d ⁻¹ $t = 227.2$ mg/L $V_3 = 3,121,613$ gallons $Q = 1,118,900$ gpd $k_H = 0.30$ d ⁻¹ $t = 2.79$ days $C_1 = 227.2$ mg/L $C_3 = 124.5$ mg/L $V_3 = 3,121,613$ gallons $Q = 1,118,900$ gpd $k_H = 0.30$ d ⁻¹ $t = 2.79$ days $C_3 = 124.5$ mg/L $V_2 = 2,211,984$ gallons $Q = 1,118,900$ gpd $k_H = 0.30$ d ⁻¹ $t = 1.98$ days $C_0 = 360$ mg/L $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons $Q = 1,118,900$ gpd $k_H = 0.30$ d ⁻¹ $t = 2.79$ days $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons $Q = 1,118,900$ gpd $k_H = 0.30$ d ⁻¹	n Series, Two parallel flow trains - MMF Summer Season $V_1 = 2,211,843$ gallons each $V_1 = 2,211,984$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 1.98 days $C_0 = 360$ mg/L $C_1 = 227.2$ mg/L $V_3 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_1 = 227.2$ mg/L $C_3 = 124.5$ mg/L $V_3 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_3 = 124.5$ mg/L $V_2 = 2,211,984$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 1.98 days $C_0 = 360$ mg/L $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 1.98 days $C_0 = 360$ mg/L $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $V_4 = 124.5$ mg/L $V_3 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $V_3 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $V_3 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $V_3 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days	n Series, Two parallel flow trains - MMF Summer Season (High temp , V = 3,121.613 gallons each V ₁ = 2,211,984 gallons Q = 1,118,900 gpd k _H = 0.30 d ⁻¹ t = 1.98 days C ₀ = 360 mg/L C ₁ = 227.2 mg/L V ₃ = 3,121,613 gallons Q = 1,118,900 gpd k _H = 0.30 d ⁻¹ t = 2.79 days C ₁ = 227.2 mg/L C ₃ = 124.5 mg/L V ₃ = 3,121,613 gallons Q = 1,118,900 gpd k _H = 0.30 d ⁻¹ t = 2.79 days C ₃ = 124.5 mg/L V ₂ = 2,211,984 gallons Q = 1,118,900 gpd k _H = 0.30 d ⁻¹ t = 1.98 days C ₀ = 360 mg/L C ₂ = 227.2 mg/L V ₄ = 3,121,613 gallons Q = 1,118,900 gpd k _H = 0.30 d ⁻¹ t = 1.98 days C ₀ = 360 mg/L C ₂ = 227.2 mg/L V ₄ = 3,121,613 gallons Q = 1,118,900 gpd k _H = 0.30 d ⁻¹ t = 2.79 days C ₂ = 227.2 mg/L V ₄ = 3,121,613 gallons Q = 1,118,900 gpd k _H = 0.30 d ⁻¹ t = 2.79 days C ₂ = 227.2 mg/L V ₃ = 3,121,613 gallons Q = 1,118,900 gpd k _H = 0.30 d ⁻¹ t = 2.79 days	n Series, Two parallel flow trains - MMF Summer Season (High temp & MMF $\sqrt{1} = 3,121,613$ gallons each $V_1 = 2,211,984$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 1.98 days $C_0 = 360$ mg/L $C_1 = 227.2$ mg/L $V_3 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_1 = 227.2$ mg/L $C_3 = 124.5$ mg/L $V_3 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_3 = 124.5$ mg/L $V_2 = 2,211,984$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 1.98 days $C_0 = 360$ mg/L $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 1.98 days $C_0 = 360$ mg/L $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days $C_2 = 227.2$ mg/L $V_4 = 3,121,613$ gallons Q = 1,118,900 gpd $k_H = 0.30$ d ⁻¹ t = 2.79 days	n Series, Two parallel flow trains - MMF Summer Season (High temp & MMF flow cond $V_1 = 3.121.613 gallons each$ $V_1 = 2.211.984 gallons$ Q = 1,118.900 gpd $k_{H} = 0.30 d^{-1}$ t = 1.98 days $C_0 = 360 mg/L$ $C_1 = 227.2 mg/L$ $V_3 = 3.121.613 gallons$ Q = 1,118.900 gpd $k_{H} = 0.30 d^{-1}$ t = 2.79 days $C_1 = 272.2 mg/L$ $V_3 = 3.121.613 gallons$ Q = 1,118.900 gpd $k_{H} = 0.30 d^{-1}$ t = 2.79 days $C_3 = 124.5 mg/L$ $V_5 = 68.2 mg/L$ $V_2 = 2.211.984 gallons$ Q = 1,118.900 gpd $k_{H} = 0.30 d^{-1}$ t = 1.98 days $C_0 = 360 mg/L$ $C_2 = 227.2 mg/L$ $V_4 = 3.121.613 gallons$ Q = 1,118.900 gpd $k_{H} = 0.30 d^{-1}$ t = 1.98 days $C_0 = 360 mg/L$ $C_2 = 227.2 mg/L$ $V_4 = 3.121.613 gallons$ Q = 1,118.900 gpd $k_{H} = 0.30 d^{-1}$ t = 2.79 days $C_2 = 227.2 mg/L$ $V_4 = 3.121.613 gallons$ Q = 1,118.900 gpd $k_{H} = 0.30 d^{-1}$ t = 2.79 days $C_2 = 227.2 mg/L$ $V_3 = 3.121.613 gallons$ Q = 1,118.900 gpd $k_{H} = 0.30 d^{-1}$ t = 2.79 days $C_2 = 227.2 mg/L$

Boyle Engineering Corporation

BY: EKM	DATE: 12/1/20	06 SUBJECT	Southlan	d WWTF Master Plan	JOB NO:	19996.17
CHKD. BY:	DATE:		Future P	rojected Solids Productio	<u>n</u> (2030)	
Determine: Vo	olume of solids adde	d to ponds over 5	years at pi	rojected 2030 flowrate.		
Assumptions:						
AAF =	1.67 mgd Aver	age TSSin = 265	5 mg/L	Average TSSout =	40 mg/L	
1) Total	volume of wastewat	er treated in past	5 years			
	V = Q x t					
	V = 1.67 mgd x 3	5 yrs x 365 days/y	r			
	V= 3048 Mga	1				
2) Mass	of TSS removed					
	$Mass = (TSS_{in} - TSS_{in})$	$(SS_{out}) \ge V \ge (8.3)$	4 lb/Mgal	x mg/L)		
	Mass = (265 - 40) x (13048) x (8.3	54)			
	= 5,7	19,103 lbs				
	= 1,14	43,821 lbs/yr				
3) Mass	of volatile and fixed	solids				
	$Mass_{VSS} = 0.70 x$	TSS				
		x (2,054,768)				
	= 4,00)3,372 lbs				
	= 80	00,674 lbs/yr				
	$Mass_{Fixed} = Mass$	_{rss} - Mass _{vss}				
		,768 - 1,438,337				
		15,731 lbs				
		43,146 lbs/yr				
4) Amor	unt of accumulation	at the end of 5 yea	ars			
А	ssume 60% VSS red	uction occurs with	hin 1 year			
	$(VSS)_{t} = [0.7 + 0.00000000000000000000000000000000$.4(t-1)] x VSS				
	= [0.7 + 0]	.4(5-1)] x 489,160	5			
	= 1,84	41,551 lbs				
5) Total	mass of solids					
	$Mass_{Total} = Mass$	$_{Fixed} + Mass_{Accumula}$	ated			
	= 1,048	3,213 + 1,125,082				
		57,282 lbs				
6) Volu	me of solids (assume	15% solids and d	lensity = 1	.06*8.34 lb/gal)		
	$V_{Total} = Mass_{Total}$		-	-		
	= 2,68	- ·				

Boyle Engineering Corporation

 BY: EKM
 DATE:
 12/1/2006
 SUBJECT
 Southland WWTF Master Plan
 JOB NO:
 19996.17

 CHKD. BY:
 DATE:
 Future Projected Solids Production
 (2030)

Potential percentage of solid volume in ponds over 5 years at projected flowrate

Total pond volume (taken from NCSD Southland O&M Manual, July 2000) Liquid volume = 2 @ 295,700 cf & 2 @ 417,300 cf Sludge volume = 2 @ 0.5 Mgal & 2 @ 0.7 Mgal

 $V_{Total} = [2 x 295,700 + 2 x 417,300] x 7.481 gal/cf + 2 x 500,000 + 2 x 700,000$ $V_{Total} = 13,067,906 gal$

% of solids in pond = <u>2,682,595</u> <u>13,067,906</u>

= 21% of existing pond volume for 5 years at projected future flowrate